RECORDS

OF THE

BOTANICAL SURVEY OF INDIA.

PUBLISHED UNDER THE DIRECTION OF
BRIGADE-SURGEON G. KING, M.B., LL.D., F.R.S., C.I.E.,
DIRECTOR OF THE BOTANICAL SURVEY OF INDIA.

VOLUME I.

No. 3.

REPORT ON A BOTANICAL TOUR IN KASHMIR,

BY

J. F. DUTHIE, B.A., F.L.S.,
DIRECTOR, BOTANCIAL DEPARTMENT, NORTHERN INDIA.

WITH A MAP.

CALCUTTA:
OFFICE OF SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.
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REPORT

ON

A BOTANICAL TOUR IN KASHMIR.

1893.

The portion of country botanically explored last year is indicated in the accompanying map by the red line; the blue line refers to my journey in 1892.

After a few days spent at Gulmarg I started for the Liddar valley, and explored both branches of the river up to their sources. I then crossed over the watershed by the Yamháru pass into the Sind valley, and thence proceeded over the Zoji Lá to Drás. From Drás I travelled by the little-frequented route to Gurais *viâ* Tilail. From Gurais I made an expedition over the Dorikun pass to the Deosai plains, and returned by the same route. I then went back to India *viâ* the Rájdiangan pass, Bandipur, Srinagar, and Baramula.

I will now proceed to give a more detailed account of this journey and enumerate some of the more interesting plants that were met with.

After having reported my arrival in Kashmir to the Resident and made all necessary arrangements for an extended tour, I left Gulmarg on the 5th of July for Islamabád *viâ* Margám and Srinagar. I was delayed for a few days at the latter place owing to the flooded state of the river.

The journey from Srinagar to Islamabád takes about two days by boat. The boats do not, as a rule, go further than Kanbal, which is about a mile below Islamabad. Here there is a rest-house, where I stopped for the night.

On the following day I marched to Aishmakám in the Liddar valley. The path is nearly level all the way. Below Aishmakám the valley is three to four miles wide, and richly cultivated, the numerous channels into which the river divides affording ample facilities for irrigation. The chief crop is rice of several distinct varieties, the varying tints of which are very striking, especially one with deep chocolate coloured foliage.

The next march is to Pálgam. After leaving Aishmakám the valley becomes much more contracted, the ascent is steeper, and the vegetation alters considerably. Rice cultivation is left behind ; also the chenar tree (*Platanus orientalis*), which forms such a characteristic feature in the villages of the Kashmir valley. Trees belonging to a higher zone now begin to make their appearance, such as *Aesculus indica, Prunus Padus, Carpinus viminea, Acer cæsium, Celtis australis*, and a small-leaved form of *Ulmus Wallichiana. Parrotia Jacquemontiana* is very common for a long distance up the valley. *Rhus succedanea*, (vernacular name " arkora) " was also found. Two shrubby species of *Indigofera*, viz., *I. heterantha* and *I. atropurpurea*) are abundant, as well as *Rubus biflorus* with its snowy white stems, and *Desmodium tiliæfolium*. The white-flowered Himalayan pæony (*Pæonia emodi*) also occurs here. The higher mountain slopes which come into view as we approach Pálgam seem to be more or less thickly clothed with silver fir, spruce, and pine. My camp was pitched amongst the pine trees at the edge of the forest.

The small parasite (*Arceuthobium minutissimum*) is very abundant in this valley, and the majority of the pine trees which I examined were more or less affected. The existence of the parasite can be detected from a considerabe distance, as it causes a congested growth of the branches and thus completely alters the habit of the tree, or that portion of it which is being attacked. It is sometimes found on the trunk, but is most abundant on the smaller branches, surrounding them with a moss-like covering. It flowers in September. The plant is diœceous, and the male and the female plants form separate colonies.

I arrived at Pálgam on the 15th of July. The village is situated a short distance above the junction of the two branches of the Liddar, and the elevation is about 7,000 feet above the sea.

On the 17th I took a portion of my camp to a place called Kainmal, a small marg about 3,000 feet above Pálgam on the east side of the valley. After three days and three nights of incessant heavy rain I managed on the fourth day (July 21st) to collect a large number of interesting plants up to about 12,000 feet.

The condition of the forests in this valley, like that of many others in Kashmír, is an instructive exhibition of the results of allowing every sound principle of forest conservancy to be violated. In spite of the excellent work already accomplished by the forest officer whose services have been lent to the State, a great deal of needless damage is still being committed by gujars and shepherds. As an instance, I may mention what was specially noticeable at Kainmal,

viz., the wholesale destruction of birch trees for the sake of the foliage, on which the shepherds feed their sheep and goats. I have seen similar results of this practice in other localities, but nothing to equal in extent the wholesale destruction of trees which has been taking place on the hill sides above Kainmal The forest officer is fully aware of the fact, and I notice from his report on the Kashmir forests for 1891-92 that steps are being taken to prevent any further destruction.

I returned to Pálgam on the 22nd of July, and after halting there for one day I made a short tour in the direction of Amarnáth. Ascending from the right bank of the Shisha Nág branch of the Liddar, I had my camp pitched near some gujar huts, a short distance below the Chatponsál ridge, at an elevation of about 10,000 feet. There are some fine clumps of maple (*Acer cæsium*) at this spot; otherwise, owing to its southern aspect, there is very little forest growth on this side of the Liddar valley.

The next day I crosed over into the Masjid valley, the stream from which joins the western branch of the Liddar near the village of Aro. A large number of very interesting plants were colleeted up to 13,000 feet. I was encamped that night just below the pass at the head of the Masjid valley. A shrubby kind of juniper, which is plentiful at this spot, is the only kind of fuel.

I went over the pass on the following day by a path which is rather difficult in places. The summit is about 13,500 feet. The descent on the further side is into the Sangam valley, near the head of which is a large lake; the stream from this lake joins the Amarnáth branch of the Sind river a little to the south of Báltal.

Leaving the Sangam valley on the southern side I had to cross another pass over 14,000 feet, intending to reach Astán marg; but bad weather came on, and we missed the path. We had therefore to make the best of our way down a steep valley until we reached a possible camping ground. When the mist cleared, I found that we had got into a nàla immediately above Tanin in the Liddar valley. Both sides of this nàla are thickly clothed with what might have been fine forests of birch, but the leaf-bearing branches had all been lopped for sheep fodder, and only the bare white trunks remain.

A short march through beautiful scenery brought us to Tanin the next day. After passing Harwat, a gujar camping ground, where the stream from the Astàn marg valley comes in, the path

leads through a forest of spruce and silver fir, with maple, hazel, elm, and *Prunus Padus* here and there intermixed.

I remained at Tanin on the 29th, and left on the following morning for Shisha Nàg, at the head of the Liddar valley. This is the pilgrim road to the famous cave at Amarnáth. There is a steep ascent from Tanin of about 1,000 feet through forest of birch and maple, after which the path traverses some grassy slopes at a considerable distance above the river until the camping ground of Zojpal is reached. I sent my camp across the river from here to a place called Badzulkod, where two nálas, very promising-looking for botanical exploration, open out, and went on myself up the valley to Shishá Nág, about three miles distant. This lake is about 12,500 feet above the sea, and lies at the base of an amphitheatre of bare precipitous mountains of a reddish colour streaked with black. There was a great display of flowering plants round about the lake, the majority of them of the ordinary kinds met with in Kashmir at this elevation.

The two days during which my camp remained at Badzulkod were spent in exploring the two small valleys alluded to above. The Sonsár nála, the one to the east, was visited on the first day. There is a fairly good path all the way up along the western side of this valley, which ultimately leads over a high pass into the Wardwán valley. After a rather steep ascent from the camping ground in an easterly direction, the valley takes a turn towards the south, and a small lake comes into view at an elevation of about 13,000 feet. There is a glacier at the upper end of the lake. Many interesting specimens were gathered on the cliffs forming the eastern side of the valley, and on the swampy ground near the lake.

The following day (August 1st) I spent in the Badzulkod nála. There is a small glacier at the head of it, the streams from which spread out in branches through a wide expanse of marshy ground, and here many interesting plants were collected. The deep pink colour of the flowers of *Epilobium latifolium*, which grow in masses on the moraine debris, was a striking feature in the landscape. Several rare plants were found also on some high perpendicular cliffs above the glacier.

On the 2nd of August I marched to within a few miles of Pálgam. After crossing the Liddar by the permanent snow bridge a little below Zojpal, I kept along the right bank as far as the bridge at Práslang, and thence to camp on the left bank. The vegetation on this side of the valley is remarkably luxuriant; for, in addition to the circumstance of forest growth being much more dense on slopes facing the north, the low-lying ground by the river is unusually moist,

and many of the ordinary herbaceous plants, such as species of *Aconitum Delphinium*, *Dipsacus*, etc., attain to gigantic dimensions.

I left Pálgam on the 6th of August, and encamped on a pine-covered ridge above the village of Aro on the western branch of the Liddar. There is a fine view from here looking up the Masjid valley and of the lofty peaks of Gwáshbrari, the highest of which is nearly 18,000 feet.

I went up the valley the next day to Liddarwat, a very beautiful place surrounded by immense precipices of limestone. My camp was pitched in a dense forest of silver fir. The upper part of the valley beyond Liddarwat is called Kolahoi, and here there are some fine glaciers from which this branch of the Liddar takes its rise. I explored this part of the valley on the 8th of August up to the foot of the glacier. On returning down the valley I observed some Gujars drying the leaves of *Taraxacum officinale*, which they told me they ate as a vegetable and also used medicinally as a *tonic*. They called the plant *hendi*.

From Liddarwat I went over the Yamháru Pass into the Sind valley. The path turns up a small valley towards the west in the direction of the high-level lakes, Már Sár, Tár Sár, and others. My first halting-place was on a ridge about four miles to the east of Tár Sár. I explored some very interesting botanical ground near this place up to nearly 14,000 feet.

I crossed over the pass on the 12th. With the exception of the last 500 feet the ascent is quite easy. I saw some very fine examples of *roches moutonneés* at the head of the valley leading to the summit, also several rocks with polished and furrowed surfaces.

Many rare and interesting plants were collected near the top of the pass, the elevation of which is about 13,000 feet.

The descent to Kullan on the northern side is very steep, and the path is extremely slippery, especially in wet weather. All this side of the Sind valley is densely clothed with forest from about 12,000 feet to the base of the valley. The *Kut* plant (*Saussurea Lappa*) is abundant between 10,000 and 12,000 feet; also *Inula Royleana* with its immense heads of yellow flowers.

At Kullan I had to halt for one day to re-arrange loads and attend to the numerous botanical specimens which had been collected up to that date. I then went up the valley to Sonamarg, from which place I visited the Tájwáz valley, where many valuable specimens were collected. Between Sonamarg and Báltal the road passes through a forest composed of *Pinus excelsa*, *Populus ciliata*, and willow. I noticed that many of the pines were much injured by the attacks of the minute parasite, *Arceuthobium minutissimum*.

I left Báltal on the morning of 20th for the Zoji Lá, and pitched my camp at the entrance of the Kainpatri nála, from which one of the principal sources of the Sind river takes its rise. I ascended this nála in the afternoon as far as the moraine of the central glacier and collected many specimens.

On the following day (August 21st), after crossing the watershed which divides the Sind valley from that of the Drás, I proceeded to Mataiyan, and arrived at Drás on the 22nd.

The Zoji Lá is remarkable for being the lowest depression in the great chain of mountains extending for about 300 miles from Khágán on the west to the eastern sources of the Chenáb. The height of the pass is only 11,500 feet, and by it we step, as it were, on to the high level country of Ladák. By whichever pass we cross to the north of this great chain of mountains, a very conspicuous change in the vegetation cannot fail to be observed.

I halted for a few days at Drás in order to make myself acquainted with the surrounding vegetation, which, though scanty, is very interesting. An expedition I made to the Lamchan nála, a wild-looking rocky gorge on the opposite side of the river, fully rewarded me for all the toil and trouble which had to be undergone. The locality, as seen from a distance, presents a most unpromising appearance, but after climbing for a long time over loose boulder debris, which fills up the entire bed of the ravine, I was fortunate in securing a great many rare and interesting specimens. Some of these, such as *Oxygraphis polypetala*, *Delphinium Brunonianum*, *Corydalis crassifolia*, *Geranium polyanthes*, and *Allardia tomentosa*, were growing amongst the boulder debris, beneath which glacier water was trickling, though not visible. The higher we ascended, the more varied and interesting the vegetation became, until we reached an elevation of about 12,000 feet, above which no vegetable life was visible—nothing but rock, and the evidence of havoc wrought by avalanches of rock and snow.

From Drás I travelled to Gurais *viá* Tilail. Although this is the most direct route, it appears to be very little used as a trade thoroughfare. Two passes have to be crossed, one leading over to the head of the Tilail valley, and the other over the ridge between Tilail and the Burzil valley. The former is between 13,000 and 1,4000 feet high; and, like the Zoji Lá and the Dorikun and Kamri passes, is a depression of the great mountain chain which traverses Kashmir from north-west to south-east. The ascent on either side is very gradual. The other pass leading to the Burzil valley is about 12,000 feet only, but it is much steeper and very difficult for laden ponies in wet weather, especially on the Burzil valley side. By

continuing the road through the narrow gorge of the Kishenganga valley, which opens out a few miles to the east of Gurais, the latter pass could be altogether avoided, to the great advantage of both man and beast.

Starting from Drás the road leads up a valley towards the west. It is fairly good until after passing the villages of Holál and Mushki; beyond this the ground is steep and rocky, and rather difficult even for coolies. The baggage ponies had to be taken across to the right bank of the stream, and by a steep zigzag path along the face of an old glacier moraine to the village of Battakulan where it joins the other path. The elevation of Battakulan is between 11,000 and 12,000 feet. It lies on the left bank of the stream, and is sheltered by enormous promontories of moraine debris. There are no other villages above this.

After halting here for the night, I went on up the valley the next day to a camping ground called Rimochama. The valley opens out very considerably above Battakulan. The ascent is very gradual, and the gently flowing stream forms many channels with intervening islands covered with *Hippophæ salicifolia* and different kinds of willow. A species of *Ephedra* (*E. Gerardiana*) is very abundant and conspicuous with its scarlet berries, and the hill sides are tinged with the crimson autumnal tint of *Polygonum tortuosum*.

As this part of the country has been very little explored, except for sport, I determined to make very short marches. Owing to the small amount of traffic along this route, and the abundant snowfall during the winter months, there is no well-defined track above Rimochama; and what there is, follows the bed of the stream which has to be forded several times. There was a good deal of snow forming vertical walls on either side of the stream. This is named the Koorudgi stream in the Atlas Sheet No. 28, but the name given to me for the valley above Buttakulan was Chatpáni. There is a fine mass of bare precipitous peaks at the head of the valley.

We had now reached an elevation of about 13,000 feet, and as the ground looked very promising for botany, I decided to halt here for the night, so as to have the whole of the next day for studying the vegetation of the pass. I collected a great number of plants and seeds that evening at the head of the valley.

The next day (August 30th) was beautifully fine, with a cloudless sky. The top of the pass was soon reached by a steep but easy path over turf. The elevation of this pass is close under 14,000 feet. I can find no name given for it in any maps, but it is known by the Drás people as the Kargeh pass. The view looking down

the valley towards Tilail, is very fine, with Nanga Parbat in the distance. On the pass itself there was very little snow, and the turf was studded with brilliantly-coloured alpine flowers.

A short distance below the pass, on the Tilail side, is a small lake about 300 yards long and 100 yards wide. Some very interesting specimens were collected round the shores of this lake, and on the debris-covered slopes on either side. The stream which issues from this lake is one of the sources of the Kishenganga river.

My intention was to have marched on this day as far as Abdulan, which is the highest village on the side of the pass; but, owing to the swollen state of the stream, I had to halt for that night at a place about two or three miles above the village. The next day, after crossing the stream to the left bank, we had to ascend along the side of the valley for several hundred feet, as the snow bridges over the river had given way. This part of the road is a very difficult one for laden ponies.

Abdulan is a small village, consisting of twelve houses. The elevation above the sea is about 10,500 feet. There is a good deal of cultivation around the village, consisting chiefly of barley and buckwheat. The former was then being harvested, and the buckwheat was looking very promising. A few miles below Abdulan is another village, called Gujeru, where the path crosses the river by a bridge.

The road now keeps along the right bank all the way down the valley, which for several miles extends almost due west. The two sides of the valley are remarkably different in regard to the character of the vegetation. The hill sides exposed to the north are thickly clothed with forest, whilst the opposite sides are almost bare of trees, with the exception of occasional stunted specimens of pencil cedar, and the vegetation resembles that of Baltistán.

The valley becomes very much wider below the village of Gujeru, and there is a large extent of cultivated ground on either side of the river, with numerous small villages scattered here and there. I managed to get as far as Bariáb on this day (31st August). This village is prettily situated near the junction of a tributary stream from the north. On the opposite side of the main valley is the Ráman Sind nála.

I left on the following morning for Baragám, a village about 500 feet lower down the valley. Some portions of the road are decidedly dangerous for ponies, and the loads had frequently to be taken off and carried by coolies. The erection of a few bridges across the river would obviate all such difficulties.

I was much struck with the large amount of land cultivated and available for cultivation in this portion of the valley, as well

as the excellent appearance of the crops, consisting chiefly of barley, *chena*, and buckwheat. The construction of a proper road between Drás and Gurais, *viâ* Tilail, would be the means of developing very considerably the capabilities of this valley as a source of supply to less-favoured districts. There are only two places where any serious obstacles would have to be overcome, *viz.*, just below the village of Battakulan on the Drás side, and the narrow gorge of the Kishenganga between Tilail and Gurais.

The elevation of Baragám is about 9,000 feet. The principal crop is buckwheat, of which two kinds are grown, *viz.*, *Fagopyrum esculentum* and *F. tataricum*. I also saw fields of *chena* (*Panicum miliaceum*), and of a variety of mustard. All the grass and weeds on the hill-sides were being cut and stacked as fodder for winter use. My next halting-place was Zargei. The flat ground by the river is covered with a dense jungle of willow, and a little lower down the valley narrows suddenly into the precipitous gorge leading to the Burzil valley.

The officials in this part of the valley gave me a good deal of trouble by their unwillingness to provide transport and supplies. They are very independent and somewhat insolent in their manner, the result, no doubt, of the inaccessibility of the place.

The next day (4th September) I went over into the Burzil valley, and encamped near the village of Surwán. The path leaving the Kishenganga valley about a mile below Zargei village, turns up the Barnei nála towards the north, and after a gradual ascent for two or three miles, a steep zigzag climb brings you to the top of the ridge overlooking the Burzil valley. There is a grand view from here of the Tilail valley, and of the snowy peaks in the neighbourhood of the Kargeh pass. The northern slopes of this ridge are, as usual, well clothed with forest. The descent to the Burzil valley is through forest all the way, and the path is a very steep one. The village of Surwán is on the left bank of the Burzil stream, and on the opposite side is the road to Gilgit. I reached Gurais on the following day.

What is known as the Gurais valley is in reality only a wide stretch of the Kishenganga valley. It is about four miles long and one mile across in some parts. The slopes facing the north are covered with spruce and silver fir, and pine trees form an irregular belt below. On the opposite side are steep limestone mountains, which rise to over 6,000 feet above the valley. Scattered here and there on the cliffs are a few juniper trees, and the lower slopes are covered with *Artemisia maritima*, which gives the

northern side of the valley that peculiar grey-glaucous appearance so characteristic of the scenery of the dry country around Astor and Gilgit.

At the lower and western end of the Gurais valley, where the river begins to turn southwards in the direction of Kanzalwán, is a remarkable forest composed chiefly of the white poplar (*Populus alba*); and about a quarter of a mile lower down the valley, and on the same side of the river (the left bank), there is a similar piece of forest. The trees are growing close together, and when viewed from the steep hill above, their tops present a level mass of compact foliage, a few individual trees projecting here and there. The chief interest attached to this forest is the large size of the trees, their average height being over 100 feet. Mr. W. Mitchell, who happened to be at Gurais at the time, kindly assisted me in making some measurements. The largest specimen we could find was 127½ feet high and 16 feet in girth at 7 feet from the ground. In the "Forest Flora of North-West and Central India," Sir D. Brandis gives the maximum size of *Populus alba* in India as 40 feet in height and 8 feet in girth.

The undergrowth of this forest is composed chiefly of a tall, handsome *Senecio* (*S. chenopodifolius*) and a low-growing kind of bramble. A few isolated specimens of pine, spruce, and silver fir are met with; also *Populus ciliata*, two species of willow, *Crataegus Oxyacantha*, *Viburnum foetens*, and *Hippophae rhamnoides;* this latter forms large thickets a little higher up the valley.

After a short stay at Gurais, I made an expedition to the Shersár lake on the Deosái plains. As far as Chilam, on the further side of the Dorikun pass, the new Gilgit road is followed, and from there a path up the Balsir valley leads direct to the lake. On the first day I went as far as Bangla, where the road from the Kamri pass comes in, and thence to Minimarg at the junction of the Nagai river. This is really a larger stream than the Burzil before they become united. It rises near the pass leading over into the Shingo valley. There are a few houses at Minimarg, and some cultivated fields where buckwheat is grown. The elevation is about 10,000 feet.

I made a short march on the following day (September 13th) to Burzil, and in the afternoon I was able to explore some good botanical ground along the path leading direct to Skárdu from here. Several interesting plants, as well as seeds, were collected up to about 12,000 feet. The rock here is granite.

I went over the pass on the 14th to Chilam, a distance of eighteen miles. This is rather a long march, but perfectly easy when the

snow is off the ground. The most striking feature to be noticed at this time of the year is the brilliancy of the autumn tints produced chiefly by the abundance of two or three species of dwarf willow, and by the pink and scarlet blossoms of *Polygonum affine*. Some interesting plants were found near the summit of the pass, and one in particular, *viz.*, a variety of *Primula Stuartii* with cream-coloured flowers, which I had not known of before. Some seed of this was secured, also of *P. rosea*, which is very abundant here. The elevation of the pass is 13,500 feet. There is a long descent of about 2,000 feet to Chilam. There is no village here, but a rest-house has been built close to the stream which comes down the Balsir valley, the main stream being a branch of the Astor river. On the right bank, just before reaching Chilam, a fine piece of pine forest is passed.

The Shersár lake was reached on the following day (15th September). There is a fairly good path up the Balsir valley over undulating grassy slopes and across numerous deeply-cut water-courses. It is, however, quite easy for ponies. As no fuel is obtainable in the neighbourhood of the lake, I had to collect a pony load of it on the way up. The stream is thickly fringed with willow bushes on both sides. The Chuchor Lá, or the pass leading over to the Deosai plains, is a narrow grassy depression of the mountain chain which forms the western boundary of the great plateau. On reaching the summit, the view which suddenly presents itself is a very striking one. The big lake occupies the foreground with a low range of rocky hills behind, and to the left of the lake there is a good view of the undulating grassy plateau stretching away to the base of the lofty chain of the snowy peaks in the direction of Skárdu. The lake must be about six miles in circumference, judging from the time it took one of my Gurais coolies to walk round it on the evening of my arrival.* The lake is very deep, and is said to contain fish. I was told, however, that the capture of fish out of this lake was immediately followed by a violent storm. During the time I was there the weather was abnormally warm for the elevation, and the absence of any sounds, excepting the occasional shrill cries of marmots, was almost overpowering.

A few interesting plants were gathered near the shore of the lake, but the vegetation generally was in a dried-up condition. I noticed many plants still in flower, which on being handled crum-

* The object of his excessive energy was to win a bet he had made with one of the other coolies.

bled to dust. This condition of the vegetation is not unusual at high elevations, where early and sudden frosts take place in a still air.

I returned to Chilam the next morning, and on the following day (17th) crossed the Dorikun pass in a storm of wind and sleet, and reached Minimarg the same evening. I halted here for a day to dry the tents, and this gave me an opportunity of exploring some forest ground on the further side of the stream. The most interesting discovery here was that of *Pyrola secunda*, a species which had not been recorded for India previous to my finding it in the Astor valley in 1892. The undergrowth in this forest is composed chiefly of a variety of *Rubus niveus*, with red fruit tasting exactly like that of the raspberry, and of black-currant bushes with their branches bent down with the weight of the fruit. Another kind of bramble (*R. saxatilis*), with scarlet fruit, is also abundant here. The natives call it "*popé.*" A large number of interesting mosses were collected here.

From Minimarg I marched to Gurais, and, after halting there for a few days, returned to Srinagar by the Rájdiangan pass, and thence to India *viâ* Baramula and Murree.

J. F. DUTHIE,

Director, Botanical Department,
Northern India.

SAHARANPUR,
The 6th August 1894.

Notes on some of the Economic Plants met with in Kashmir, and in the districts of Baltistán and Gilgit.

As my tours in Kashmir during the last two years were made chiefly through mountainous and uncultivated portions of that country, I had not many opportunities for studying the more important agricultural crops. These, however, will be fully described by Mr. Lawrence in his forthcoming settlement report.

The following information is taken mainly from notes made during these tours. I have been careful, as far as possible, to avoid the repetition of facts already recorded in the Dictionary of Economic Products.

Abies Webbiana, Lindl., *var. Pindrow*—(Silver fir).—One of the principal constituents of the high elevation forests, called *kátul* in the Naltar valley, north of Gilgit.

Abutilon indicum, G. Don.—Common in the valley, where the fibre is much used.

Aconitum ferox, Wall., *var. moschatum*, Bruhl, M. S.—This plant which has a strong musky odour, like that of *Delphinium Brunonianum*, is regarded by Mr. Bruhl as a new sub-species or variety of *A. ferox*. The flowers are of a brownish colour and covered with viscid hairs. I found it growing on rocks in the Musjid valley at about 12,000 feet, and on similar rocks in the Sonsal nála at from 13,000 to 14,000 feet.

Aconitum heterophyllum, Wall.—A very common plant in Kashmir, especially on the open margs. It is called "*manguálu*."

Aconitum Lycoctonum, Wall.—Abundant in forests between 8,000 and 12,000 feet. The flowers are sometimes musk-scented.

Aconitum Napellus, L.—(Monkshood).—The following varieties were met with:—

Var. *dissectum*,—Baltistan, 11,000 to 12,000 feet.
" *multifidum*, Dorikan pass, 11,000 to 13,000 feet; Baltistan, 13,000 to 14,000 feet; Gilgit district, 10,000 to 11,000 feet.
" *rotundifolium*—Astor valley, 11,000 to 12,000 feet.
" *spicatum*—Kashmir, 9,000 to 11,000 feet; Baltistán, 11,000 feet.
" *tauricum*—Baltistán, 13,000 feet.

Mr. Bruhl, who is at present engaged in the preparation of a monograph of the *Ranunculaceæ*, was kind enough to identify the above.

Actæa spicata, L. (Baneberry).—Common in forests on the Pir Panjál and Kájnág ranges between 8,000 and 12,000 feet.

Althæa rosea, L. (Hollyhock).—Abundant in the neighbourhood of villages in the Astor valley, where it is called "*Chamma*". It is much used for planting on graves.

Andropogon Gryllus, L.—Called "*pakhor*" in Astor valley. Used as fodder.

Anemone obtusiloba, Don.—A common plant in Kashmir, and very variable both as to habit and in the colour of the flowers. A dwarf variety with bright yellow flowers is found at high elevations.

Apocynum venetum, L.—Found on the banks of the Naltár stream above Nomal in the Hunza valley. Dr. Aitchison in his "Notes on the Products of Western Afghanistán and Persia," page

13, states that the annual shoots of this plant yield a fibre, from which the Turcomans to the east of Bokhará prepare twine and ropes, and that the bark of the underground stems is employed in tanning, and for the preparation of skins intended for holding water.

Arenaria holosteoides, Edgew.—A common weed in wheat-fields in Baltistán. It is eaten as a vegetable.

Artemisia maritima, L.—A characteristic plant of Baltistán and of the valleys in the Gilgit district. In the Bulletin of the Royal Gardens, Kew, for June 1893, there is a notice of this plant under the heading of "Wormwood as a Fodder Plant," together with a report by Professor A. H. Church, F. R.S., on a chemical analysis undertaken by him of a sample which I collected in the Astor valley in 1892. The following is his report:—

"I have submitted the sample to analysis, mixing the material "together as uniformly as possible. The harsh, woody texture of the "plant and its powerful but sickly odour would not commend its use "as the chief ingredient in horse fodder; but its chemical composition "turns out more favourable than I expected. I think it is extremely "probable that the aroma of this plant is chiefly due, like that of "common wormwood, to *absinthol* (C_{10} H_{16} O), a liquid isomer of "camphor. But a bitter principle called *absinthin* (C_{40} H_{58} O_9), which "is found in *Artemisia Absinthium*, has the smell of wormwood "and may be present in the present plant; to separate it and identify "it would, however, require a large quantity of material.

"Percentage composition of *Artemisia maritima*—

Water	13·6
Oil, resin, wax, etc.	4·0
Starch, sugar, gum, etc. (by difference)	34·2
Albuminoids (true)	6·0
Fibre	33·9
Ash (includes 2·7 of sand and mica)	8·3

"It should be mentioned that the 4 per cent. set down as oil, "resin, wax, etc., consists of the matters extracted by ether, of "which it was found that three-fourths were soluble also in very "strong alcohol, and were consequently for the most part resinoid "and aromatic compounds. The albuminoids were determined by the "phenol method: had they been calculated from the total nitrogen "found, they would have appeared higher (8 per cent).

"This plant contains rather less albuminoids, less digestible "carbohydrates and more fibre than the average hay of mixed grasses.

"It is, however, thrice as rich in albuminoids as the straw of European "cereals, which contain about 10 per cent. more fibre than this "*Artemisia.*"

Dr. Aitchison, in his "Notes on the Products of Western Afghanistan and Persia," page 15, alludes to this species and *A. campestris* as existing everywhere over the dry and stony country, and forming the chief fodder for cattle on those arid tracts. He also says that camels and donkeys thrive on this fodder, and that the horses of the country seem to relish and fatten upon it.

Artemisia scoparia, W. and K, Vern. "*Jha*" in the Astor valley.—Used as fodder

Avena sativa, L. (Oats), Vern. *Shashier* (Astor valley), *Shiasha* (Satpur valley near Skárdu), *Yupo* (Indus valley below Skárdu).

Berberis Lycium, Royle.—Abundant in the lower valleys; called "*kandach*" in the Sind valley.

Berberis vulgaris, L. (common Barberry) and varieties.—Plentiful in Kashmir and Baltistán up to 12,000 feet.

Betula utilis, Don.—Called "*Jeonji*" in the Naltar valley north of Gilgit, and the bark is known as "*buraj.*"

Brassica campestris, L., var. *Rapa* (Turnip).—Called "*Gonglu*" in the Satpur valley above Skárdu.

Capparis spinosa, L.—Rocks in Baltistán and in the Gilgit district.

Cichorium Intybus, L. (Chicory).—A common weed in the valley.

Cnicus arvensis, Hoffm.—The fresh plants of this species are used in the Indus valley near Skárdu for manuring tobacco crops. It is there called "*kanish.*"

Corydalis Govaniana, Wall.—Common at high elevations along the edges of water-courses.

Corylus Colurna, L. (Himalayan hazel).—Common in the forest between 8,000 and 12,000 feet.

Dictamnus albus, L.—Kashmir and Baltistán, 8,000 to 9 000 feet.

Datisca cannabina, L., vern. "*Akalbir.*—" Burzil valley, 9,000 feet; Astor valley, 7,000-8,000 feet; called "*bhong*" in the Astor district.

Delphinium Brunonianum, Royle.—11,000 to 14,000 feet.

Delphinium denudatum, Wall.—5,000 to 8,000 feet.

Delphinium speciosum, M. Bieb, var. *ranunculifolium*; vern. "*Nil*" or "*zornil.*"—Forests in the Liddar valley, 10,000 to 12,000

feet. I was told by Gujars that the root of this plant is very poisonous to cattle. I am indebted to Mr. Bruhl for its correct identification.

Fagpoyrum esculentum, Moench.—(Buckwheat); vern. "*Pháphra*" or "*ogal.*"—Widely cultivated in Kashmir and Baltistán.

Fagopyrum tataricum, Gaertn.—(Buckwheat); vern. "*Trumba*" and "*chini troma*" (Sind valley).—A hardier and more robust species and grown usually at higher elevations. I have frequently seen both kinds in the same field. The buckwheat harvest varies according to the elevation; in the Tilail valley, at 10,000 feet, it was being cut on the 1st of September.

Ferula Jaeschkiana, Vatke; vern. *Ápatkanphur* (Sind valley), *kángwa* (Pir Panjál).—A tall, handsome, umbelliferous plant, with yellow flowers, abundant in most of the valleys in Kashmir. This plant was at one time supposed to be a source of "*asafœtida.*" It resembles *F. Narthex*, Boiss, but has much larger fruit. The plant is said to be eaten by sheep and goats.

Ferula Narthex, Boiss., Syn. *Narthex asafœtida*, Falc.—Abundant in the Astor valley below Doian. I remember when on my way to Gilgit noticing this plant, only the dry bleached stems being then visible. There is a specimen in the Saharanpur herbarium collected by Dr. Giles in 1886, and probably from the same locality. I agree with Dr. Aitchison in considering this to be the plant which Dr. Falconer supposed to be the true source of the drug. The root is full of a resin which has a powerful scent of *asafœtida*. The plant is figured in the Botanical Magazine, t., 5168, and in Bentley and Trimen's Medicinal Plants, t. 126.

Fraxinus xanthoxyloides, Wall.—Called "*Kásuna*" in the Naltar valley north of Gilgit.

Gossypium herbaceum, L., called "*khaians*" in the Hunza valley north of Gilgit.

Hordeum vulgare, L. (Barley); vern. "*Wiska*" (Sind valley), "*nas*" (Baltistán), *Yo* (Naltar Valley north of Gilgit).

Indigofera Gerardiana, Wall., var. *heteranatha*.—An abundant plant in Kashmir up to 9,000 feet, growing gregariously in most of the lower valleys. It is called "*send*" in the Sind valley. Its twigs are much used for basket-work; and occasionally for the construction of rope bridges.

Iris Sisyrinchium, L.—This is the small blue-flowered species so common in the valley. The foliage is largely used as fodder.

Iris Kashmiriana, Baker.—A large, handsome species, much used for planting over graves.

Jaeschkea gentianoides, Kurz.—Common in Kashmir. The whole plant is extremely bitter, much resembling *chiretta* in taste.

Juniperus macropoda, Boiss.—(Pencil Cedar).—A characteristic tree of Baltistán, also found in Kashmir on hill-sides exposed to the south. Called "*chili*" in the Astor valley, and "*shupa*" in the Shingo valley.

Lathyrus sativus, *L.*, called *Gharás* in the Satpur valley above Skárdu.

Medicago sativa, *L.* (Lucerne).—Apparently wild in many parts of Kashmir and Baltistan. Called "*Rishka*" in the Astor valley.

Megacarpæa polyandra, Benth.—A very singular looking *Cruciferous* plant, with tall thick stems and large flat seed-pods. It is extremely abundant in the Kamri valley up to 12,000 feet, and I have also met with it on the hill-sides above Gulmarg. The leaves are much sought after by the natives, who use them as a vegetable. The plant is known under the names "*Chach*," "*Chatri*," and "*Chattarhak*."

Melilotus alba, Lamk.—Called "*Bish ishpit*" in the Astor valley.

Melilotus officinalis, Willd.—Called "*Ishpit*" or "*ispit*" in the Satpur valley above Skárdu.

Mentha sylvestris, *L.*, var. *Royleana*.—Used as fodder in the Astor valley, where it is called "*Pillil*."

Morus sp.—The "*Sháh tut*" of the Skárdu district; also called "*kachilosa*." Fruit large, black, and very juicy.

Myricaria elegans, Royle.—River beds in Baltistán, where it is known under the name of "*Umbu*."

Myricaria germanica, Desv.—River beds in Kashmir and Baltistán.

Nicotiana rustica, *L.* (round-leaved tobacco).—Grown to some extent in the Indus valley below Skárdu, at an elevation of about 8,000 feet.

Oryza sativa, *L.* (Rice).—Two distinct classes of rice are grown in the valley, the red and the white, with many varieties of each. The red varieties, though less esteemed, are more commonly cultivated on account of their being more hardy. (See Dictionary of Economic Products of India, Volume V, page 622).

Pæonia emodi, Wall.—Common in the Liddar valley.

Panicum miliaceum, *L.*, vern. "Chena".—Extensively cultivated in the Tilail valley, where it is called "*chini*."

Parrottia Jacquemontina, Dcne.—A gregarious shrub, abundant in all the valleys south of the Central Kashmir chain of mountains up to 8,000 feet.

Physochlaiana prœalta, Hook. f.—Abundant in the vicinity of villages. Captain Yielding informs me that several ponies belonging to one of his contractors died last year from eating a certain plant called "*langtan*" at the village of Minawar near Gilgit. Judging from the description given to me, I am inclined to believe that this is the plant alluded to.

Pinus excelsa, Wall—(Blue pine or *chil*).—Abundant all over Kashmir, and usually forming the outer or lower belt of the forests of spruce and silver fir. In almost every instance where I have seen this tree growing in any quantity, the minute *Loranthaceous* parasite, *Arceuthobium minutissimum*, has been detected. The native name for *Pinus excelsa* in the Astor valley is "*chui*"; and in the Shigar valley in Baltistán it is called "*Showi.*"

Pinus Gerardiana, Wall.—Abundant between 8,000 and 9,000 feet in the Astor valley, where it is called '*Garol.*"

Pisum sativum L. (Pea).—Called "*Kukan*" in the Satpur valley above Skárdu; also "*stranma*" in other parts of Baltistán.

Podophyllum emodi, Wall.—Common in forests. The fruit is eaten; vern. "*Wanwanganu.*" In the Naltar valley beyond Gilgit it is called "*ichiya.*"

Populus alba, L. (White poplar); vern. "Pras" (Sind valley), "*naumer*" (Indus valley near Skárdu). See page 34 for a description of the remarkable forest of white poplar in the Gurais valley.

Populus ciliata, Wall.—Called "*Berpar*" in the Shingo valley, Baltistán.

Prangos pabularia, Lindl.—Common in the dry valleys of Baltistán. In the neighbourhood of Drás I have seen large stacks composed entirely of this plant which had been collected as fodder for winter use. It is also very abundant in the Tilail valley.

Rheum emodi, Wall.—Called "*Pombak*" in the Liddar valley.

Rhus succedanea, L.—vern. "*arkora.*"—The wood of this tree is used in the Liddar valley for the manufacture of spoons.

Ribes nigrum, L. (Black currant).—Not uncommon in the drier parts of Kashmir and Baltistàn. Fruit large and well-flavoured.

Rosa Webbianaa, Wall.—Vern. "*Sermang*" (Shingo valley, Baltistán), *Singai* (Gilgit district). Abundant in Baltistán and the drier parts of Kashmir. Very showy when in flower.

Rubus niveus, Wall.—Several varieties of this occur in Kashmir. One with a large red fruit, and flavoured like a raspberry forms a large portion of the undergrowth in a forest at Minimarg near the Burzil pass.

Salix.—Several species of willow re found in Kashmir at vari-

ous elevations. The following vernacular names are used :—"*Yihr*" (Sind valley), "*bium*" (Astor district), "*chakma*" (Satpur valley near Skárdu), "*chanmar*" (Shingo valley, Baltistán).

Sambucus Ebulus, *L.*—(Dwarf-elder).—A common weed near villages in the Sind, Liddar, and other valleys of Kashmir.

Saussurea Lappa, Clarke; Vern. "*kut*".—Kashmir forests from 10,000 to 12,000 feet. Abundant in the Sind and Burzil valleys.

Setaria italica, Beauv.—In the Naltar valley, north of Gilgit: this crop is called "*pirpit*."

Spiræa hypericifolia, *L.*; vern. "*Saber*" (Baltistán), "*tabalgol*" (Astor district).—Although not included in the "Flora of British India," the economic value of this shrub as yielding excellent material for small walking sticks has long been known to sportsmen in Baltistán, whose shikaris never fail to collect a supply. My friend, Captain Hunter-Weston, brought back flowering specimens collected in Baltistán in 1890, by means of which the plant was identified. I have since collected it on the Kájnág range, in the Satpur valley above Skárdu, in the Ditchell valley above Gudhai, and more recently in the Burzil valley near Bangla. The wood is very hard, with smooth reddish-brown persistent bark.

Stipa sibirica, Lamk.—This, which is known as the poisonous grass of Kashmir, is very abundant in some of the valleys, especially on the outskirts of the forests at an elevation of 8,000 to 9,000 feet. It occurs also in other parts of the Himalaya; and on the Black mountain in Hazara it was the cause of much sickness amongst the baggage ponies during the expedition of 1888. The direct cause of its injurious effects on animals has not yet been conclusively shown. Some attribute it to a narcotic principle inherent in the plant, whilst others affirm that it acts mechanically as an irritant, and is not in any way chemically poisonous. Dr. Aitchison, who has given much attention to the subject, and has witnessed many cases of ponies having been poisoned by eating this grass, believes that the symptoms are produced by some kind of narcotic poison. A common remedy in Kashmir for this complaint, Dr. Aitchison tells me, is to hold the animal's head in the smoke of a fire, in order to produce a discharge from the nostrils, after which the dangerous symptoms disappear, and the animal recovers consciousness. In addition to this treatment, vinegar and sour apples are sometimes given. The cattle of the country do not of their own accord eat this grass during the spring and summer, but in the autumn, Dr. Aitchison says, they do eat it. If this be so, it tells somewhat against the idea of the plant possessing only mechanically irritant properties, for during the autumn months the rough awns of the spikelets are fully developed.

Taraxacum officinale, Wigg.—In the Kolahoi valley above Liddarwat, I came across some shepherds who were spreading the leaves of this plant in the sun to dry. They told me that they used them as a tonic as well as a vegetable. They call the plant "*hendi*."

Triticum sativum, *L* (Wheat); vern. "*Čheor*" (Indus valley below Skárdu), *Kanak* (Satpur valley near Skárdu).

Vicia Faba, *L.* (Bean).—Called "*Bararak*" in Satpur valley near Skárdu.

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Director of Botanical Department,
Northern India.

The 6th August 1894.

Note on the Fodder-yielding Plants of the Gilgit District.

In my report for last year I gave a short sketch of the general character of the natural vegetation of the Gilgit valley, and endeavoured to point out by what means the supply of fodder from this source might be increased.

In order to develop as far as possible the capabilities of the district, two distinct lines of operation must be followed:—

(1) The utilization of the indigenous vegetation; (2) the cultivation of suitable fodder crops.

My stay at Gilgit was not long enough to enable me to make a complete list of the plants of the district. Of those which I did take note of, the following may be considered as more or less valuable for fodder:—

NAT. ORD. CRUCIFERÆ.—The majority of the species belonging to this family might be utilized. They are also to be recommended for their anti-scorbutic properties.

Lepidium Draba, *L.*—This plant is largely used as fodder at Quetta, and its extended growth should be encouraged in the Gilgit district. An allied species, *L. latifolium*, *L.*, is common at Nomal in the Hunza valley.

NAT. ORD. CAPPARIDEÆ—*Capparis spinosa*, *L.*—The leaves are an excellent fodder.

NAT. ORD. TAMARISCINEÆ—*Tamarix gallica*, *L.*—A common shrub along the beds of streams. It yields a good fodder for camels.

NAT. ORD. RHAMNEÆ—*Zizyphus vulgaris*, Lamk.—Sheep and goats are often fed on the leaves of this shrub.

NAT. ORD. LEGUMINOSÆ.—This family is represented by numerous shrubs and herbs, all of which may be safely used as fodder.

Melilotus officinalis, Willd., is a common weed of cultivation. *Alhagi maurorum*, Desv., is a well-known camel fodder; and of the genus *Astragalus*, several species are found wild in this district.

NAT. ORD. COMPOSITÆ—*Artemisia maritima, L.*—The most abundant plant on the lower portions of the hill-sides surrounding Gilgit. On page 38 will be found Professor Church's chemical analysis of this plant. *Scorzonera divaricata*, Turcz, is common in the valley; also species of *Lactuca*, *Sonchus* and *Tragopogon*, all of which yield more or less nutritious fodder.

NAT. ORD. OLEACEÆ—*Fraxinus xanthoxyloides*, Wall. is not uncommon in the valleys surrounding Gilgit. The foliage of this tree is used elsewhere for feeding sheep and goats.

NAT. ORD. AMARANTACEÆ—*Digera arvensis*, Forsk., *Amarantus spp.*

NAT. ORD. CHENOPODIACEÆ.—This family is largely represented in the district, and many of the species can be used as vegetable food as well as for animal fodder.

Chenopodium album, *L.*
" *Blitum*, *Hk. f.*
" *Botrys*, *L.*
" *hybridum*, *L.*
Atriplex crassifolia, *C. A. M.*
" *rosea*, *L.*
Eurotia ceratoides, *L.*
Kochia prostrata, Schrad.

NAT. ORD. POLYGONACEÆ—*Rumex hastatus*, Don.

NAT. ORD. SALICINEÆ—*Salix acmophylla*, Boiss., and other species

NAT. ORD. GRAMINEÆ.—The following is a list of the uncultivated grasses, of which specimens were observed in the Gilgit valley. This list might be considerably added to by including the kinds which occur on the high margs above the valley on either side. In 1892 large quantities of grass fodder were obtained from this source.

Andropogon annulatus, Forsk.
" *distans*, Nees.
" *Ischæmum L.* Common at Minawar.
" *laniger*, Desf.
" *Sorghum*, Brot., *var. halepense.*

Aristida spp.
Avena fatua, *L.*
Calamagrostis spp.
Eragrostis cynosuroides, *R. and S.*
" *poœoides*, Beauv.
Oryzopsis spp.
Panicum sanguinale, *L.*
Pappophorum persicum, Boiss
Pennisetum dichotomum, Del.
" *flaccidum*, Griseb.
" *lanatum*, Klotsch.
Phragmites communis, Trin.
Poa bulbosa, *L.*
Saccharum spontaneum, *L.*
Stipa spp.

A large number of nutritious plants are rejected by animals on account of their prickly nature; and, as this is a common character of the vegetation of tracts of country like that of Gilgit, it is obvious that, in order to utilize such plants in the form of fodder, some means must be adopted to disarm them. Their conversion into silage would certainly be effective in this respect, and I have reason to believe that this method of storing fodder would succeed in that climate.

Before leaving Kashmir in 1892, I had an opportunity of discussing with Captain Yielding, D S.O., the subject of fodder-supply in the Gilgit district His head-quarters happened at that time to be at Gurais, and I there gave him a memorandum embodying the results of my investigations. I also suggested to him the advisability of making a few silage experiments with the ordinary coarse indigenous vegetation. I understand that arrangements have been made for the preparation of silos at suitable localities, but as yet the results have not been communicated to me.

Several kinds of thistle, and of other plants allied to them, are plentiful in the Astor and Gilgit valleys; but owing to their being protected by thorns, they are at present unavailable as fodder to many animals. Plants of the thistle tribe are usually highly nutritious. The particular species which I remember to have seen in those valleys in any quantity are—*Carduus nutans*, *L.*, *Cnicus arvensis*, *Hoffm*, *C. involucratus*, *DC.*, *Cousinia spp.*, and *Echinops cornigerus*, *DC.* These and the widely spread wormwood (*Artemisia maritima*) all belong to the natural order *Compositae.*

The genus *Astragalus* (Nat. ord. *Leguminosae*) is abundantly represented in this district; several of the species are very prickly, and are therefore not eaten by animals. They are, however, capable of adding to the nutritive value of silage.

The cultivation of fodder crops.—Owing to the scarcity of water available for irrigation, as well as to the scarcity of labour throughout the Gilgit district, the extent to which cultivation can be carried out is limited. The numerous remains of deserted villages between Bunji and Gilgit show how much the population of this valley has decreased. Until these village sites become reinhabited, it will not be possible, owing to lack of labour, to increase the culturable area to any great extent. Wherever water for irrigation does exist, efforts should be made to encourage the growth of plants likely to be useful as fodder.

Shortly after my return from Kashmir in 1892, a large quantity of grass seed (about seven maunds), of kinds specially selected for the Gilgit climate, was despatched from Saharanpur through Captain Yielding, the Commissariat officer on special duty in Kashmir. I have not yet been informed as to the results of the sowings.

In the following year ten pounds of *Robinia* seed, imported direct from Italy, were forwarded to Captain Yielding. Sowings have been made at various places in the neighbourhood of Gilgit, as well as at Chilás, and the seedlings are now, I hear, two feet high and thriving, except at Bunji, where they were destroyed by mud floods. The successful growth of this tree in the Gilgit and Indus valleys would prove to be an immense advantage. It is a quick-growing plant, and is said to prefer open and barren situations.

Several packets of seeds of the Australian Salt-bush (*Atriplex nummularia*) have also been sent from Saharanpur for trial sowings. Being a desert plant it may possibly find a congenial home in the Gilgit district. It is much valued in Australia as fodder for sheep, especially during seasons of drought.

In addition to the above, a consignment of twenty maunds of lucerne seed (*Medicago sativa*) was sent last cold weather to Captain Yielding for sowing at various localities along the Gilgit route.

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SAHARANPUR,
The 6th August 1894.

Govt. of India Central Printing Office.—No. 415 R & A.—20-12-94.—266.—11 R.